WELLCOME INSTITUTE LIBRARY
Coll. welTROmec
Call No. pam + QX 510 1922 m36d

THE DESTRUCTION OF MOSQUITO LARVAE IN SALT OR BRACKISH WATER

J.F.Marshall

Hayling Mosquito Control,
1922, 4.

22200131627

856

THE DESTRUCTION OF MOSQUITO LARVÆ IN SALT OR BRACKISH WATER.

TROPICAL DISEASES BUREAU
RECEIVED
19 JUN. 1922

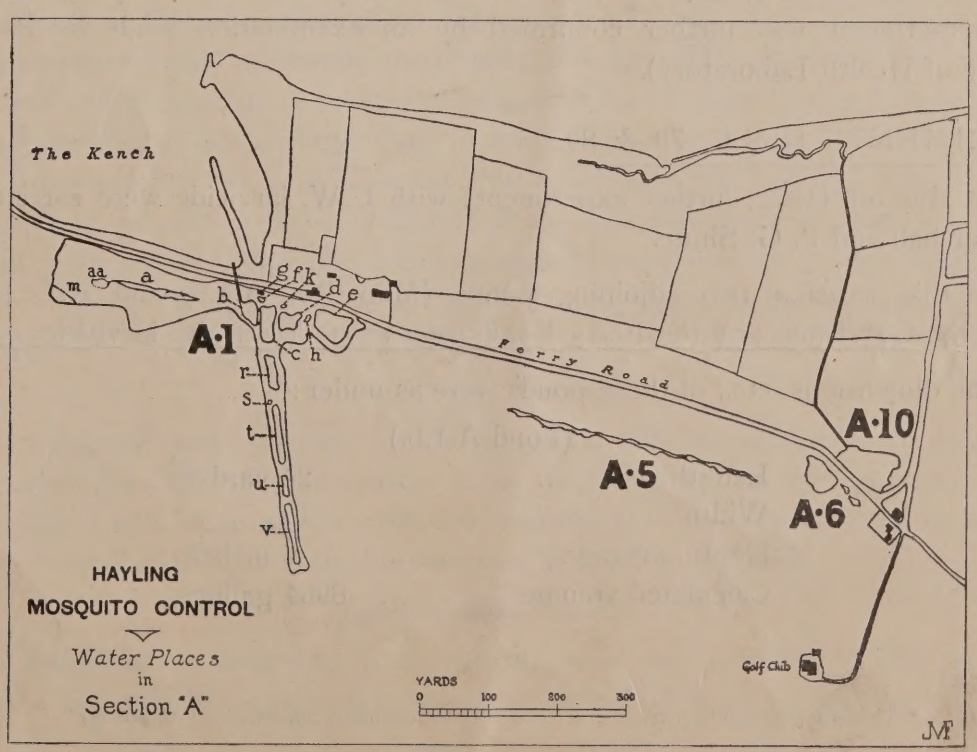
By JOHN F. MARSHALL, M.A.,
Hon. Director, Hayling Mosquito Control.

A number of experiments on the destruction of mosquito larvæ by the well-known system of "surface oiling," carried out at Hayling Island during the year 1921, supplied further evidence of the fact that this method is not one of universal application. The production of an unbroken film of a sufficiently lasting nature is sometimes an impossible task, notably in cases where the water surface is broken up by growths of reeds, etc., or is too freely exposed to the wind. In cases of this kind it is necessary to discard the oil film in favour of a "larvicide," that is to say, a substance which, by mixing with the infested water, will destroy the larvæ.

Unfortunately, however, practical information concerning larvicides is difficult to obtain. In the literature of the subject references are to be found to a number of suggested substances, but the vast majority of these stand self-condemned owing to the prohibitive cost that would be entailed by employing them in the prescribed "strengths" on any practical scale. A large number of these larvicides are, moreover, admittedly ineffective when added to brackish or salt water, and are consequently of little value in districts such as Hayling, where the salt-water mosquito, *Ochlerotatus detritus*, is the principal offender.

A number of tests have recently been carried out in the laboratory of the Hayling Mosquito Control, in the hope of discovering a larvicide which could be used successfully (and at a low cost) in salt, or partly salt, water.

It was found that a liquid containing 15 per cent. of soluble cresol, sold as a disinfectant under various names,* gave very promising results in the laboratory. This liquid, in a dilution of 1 in 16,000. was shown to kill the larvæ of *Ochlerotatus detritus* in one hour; in a dilution of 1 in 32,000, in one and a half hours; and in a dilution of 1 in 48,000, in three and a half hours, In the majority of these experiments the water containing the larvæ was of a salinity about half that of sea water.



* The liquid actually employed in the Hayling experiments was a disinfecting fluid containing 15 per cent. of soluble cresol, sold under the title of "White Cross Disinfectant," by C. S. Davies, Chemist, Havant, Hants. In the above pages this liquid is referred to as "C. W. Larvicide."

EXPERIMENT H.M.C. 73.

In order to test this liquid (hereinafter referred to as "C.W. larvicide" on a larger scale, a shallow stretch of brackish water (Map Ref. A.1.a.) adjoining the Hayling Golf Links, was selected for experiment. This water was very heavily infested with the larvæ of **Ochlerotatus detritus*, together with a large number of pupæ. The experiment was carried out on April 20th (1922) under the direction of J. F. Marshall, M.A., and Lyon Turner, B.Sc.

The volume of the water to be treated was estimated as under :—

Length	...	142 yards
Width, average	...	10 ,,
Depth, average	...	3 inches
Calculated volume	...	19,880 gallons

It was decided to use the C.W. larvicide in the proportion of 1 in 16,000. The quantity required was therefore

$$\frac{19880}{16000} \text{ gallons}$$

or 1·24 gallons.

Titration experiments carried out on the day of the experiment by Lyon Turner showed that the salinity of the water was 49 per cent. that of pure sea water.

The larvicide was applied by means of an ordinary watering can with a "rose" nozzle, the operator wading backwards and forwards across the pond. Previous trials of this method had shown that, at each double crossing, a transverse "strip" of water 4 yards in width could be treated satisfactorily. In the present case the length of the pond was 142 yards, so that 36 "there and back" journeys were necessary. The total quantity of C.W. Larvicide required for the whole pond (1·24 gallons) was therefore divided into 36 parts, one of these parts (mixed with a canful of the pond water) being distributed uniformly over each of the "4 yard strips" successively treated.

The result of the experiment was entirely satisfactory, a thorough examination on the following day failing to detect a single live larvæ or pupa. Further examinations were made with the same result on April 26th and May 2nd. On May 5th the success of the experiment was further confirmed by an examination made by P. G. Shute (Ministry of Health Laboratory)

EXPERIMENTS H.M.C. 79 & 80.

On May 5th (1922) further experiments with C.W. larvicide were carried out by J. F. Marshall and P. G. Shute.

On this occasion two adjoining ponds (Map Ref. A.1.b. and A.1.c.) situated between the Golf Links and the Ferry Road, were treated with the larvicide.

The dimensions, etc., of these ponds were as under :—

(Pond A.1.b.)

Length	...	24 yards
Width	...	12 ,,
Depth, average	...	6 inches
Calculated volume	...	8064 gallons

* This Mosquito will be hereinafter referred to by the customary abbreviation "*O. detritus*."

This pond had been inspected by P. G. Shute on March 15th (1922) and found to be heavily infested with the larvæ of *O. detritus*. At his suggestion a small blocked-up channel between the pond and the sea had been cleared: but although the resulting access of the sea had considerably diminished the number of larvæ, a large number were still present in the salt water of the pond at the date of the present experiment.

(Pond A.1.c.)

Length	...	...	45 yards
Width	...	...	10 ,,
Depth, average		...	6 inches
Calculated volume		...	12,600 gallons

This pond was very badly infested with the larvæ of *O. detritus*, a large number of pupæ being also observed.

Since the volumes of water to be treated were approximately 8,000 gallons in the first case and 12,000 in the second, a larvicide strength of 1 in 16,000 would have been obtained by the addition of a half a gallon, and three quarters of a gallon, respectively. In the first case, however, there was an appreciable amount of tidal action, tending continually to weaken the proportion of larvicide; and, in the second case, not only were there many pupæ (which offer greater resistance than larvæ do to the action of larvicides), but the water surface was broken up by numerous clumps of reeds. It was therefore decided to use one gallon of the larvicide in each case, so that the proportions actually reached were 1 in 8064 and 1 in 12,600.

In both cases the success of the previous experiment was repeated, a thorough examination of both ponds being made on the following day without a single live larvæ or pupa being found.

It was noticed during the above experiments that the addition of the C.W. larvicide to the pond A.1.c., in which the water was only slightly saline, produced the characteristic "milkiness" associated with the use of disinfectants of this class. In treating the ponds A.1.a. and A.1.b. where the water was of greater salinity, this cloudy appearance was not produced, although (as seen above) the results obtained in all the three experiments were equally successful. A series of laboratory tests showed that the "milkiness" occurred whenever the proportion of sea water to fresh water was less than 1 in 7, the cloudy appearance being uniformly distributed through the water treated. When the larvicide was added to water of greater salinity, it diffused in the form of minute globules, It was suggested by P. G. Shute that, in cases where the proportion of sea water exceeded one-seventh, the milkiness (and the accompanying uniform diffusion of the larvicide) might possibly still be produced if the larvicide were diluted with a small quantity of fresh water before use. Experiment showed this to be the case, and this preliminary dilution is obviously to be recommended whenever the larvicide in question is to be added to water of appreciable salinity.

It is extremely probable that successful results will be obtained with even smaller proportions of the C.W. larvicide than those employed up to the present, since the effects produced with dilution of 1 in 48,000 indicate that the limit has been by no means reached. Further experiments in this direction are now in progress.

It is important to note that water treated with this larvicide in the proportions mentioned is quite harmless to human beings or animals drinking it accidentally.

The comparative cost of "larviciding" and "paraffining" in any given case depends, of course, upon the depth of water to be treated. In cases where the water is shallow there is little to choose as regards expense, even when the C.W. larvicide is used in as large a proportion as 1 in 16,000. If d be the depth of any particular sheet of water in inches, n the "dilution" (or the number of parts of water which can be treated by one part of the larvicide), and c the ratio of the cost of the larvicide to that of paraffin, then the ratio of the expense of "larviciding" to that of "paraffining" has been shown by Marshall ("*Science Progress*," No. 63, p. 468) to be given by the expression

$$\frac{1500 \times c \times d}{n}$$

In the case of Experiment 73 (above described) d was 3 inches and n was 16,000. The price of the C.W, fluid was 5s. 9d. a gallon, so that c may be taken as 4. Hence the relative cost of the operation, compared to paraffining, was

$$\frac{1500 \times 4 \times 3}{16{,}000}$$

or 1·125.

the actual cost of treating the 1,420 square yards of pond being about seven shillings. It should be noted, moreover, that as the water surface in this case was much exposed to wind, paraffining carried out on previons occasions had proved quite ineffective.

Since a cubic yard is the space occupied by 168 gallons, it will be found that the number of gallons in any piece of water is

$$\frac{14}{3} \times A \times d$$

where A is the surface area in square yards
and d is the depth in inches.

So that, if the larvicide is to be used in the proportion of 1 in n, the number of gallons required will be

$$\frac{14}{3} \times \frac{A \times d}{n} \text{ gallons}$$

a useful formula for calculation, particularly when a definite value of "n" has been decided upon for treating a number of ponds. Suppose, for instance, that a larvicide is to be used in a proportion of 1 in 14,000, then the amount required will be

$$\frac{A \times d}{3000} \text{ gallons,}$$

while a 1 in 28,000 proportion would require

$$\frac{A \times d}{6000} \text{ gallons,}$$

and so on.

WELLCOME LIBRARY INSTITUTE